

**MEMORANDUM OF UNDERSTANDING BETWEEN
THE GOVERNMENT OF INDIA AND THE
GOVERNMENT OF THE UNITED STATES
OF AMERICA REGARDING INDIA-U.S.A. ITV
SATELLITE EXPERIMENT PROJECT**

18 September, 1969

Background

- 1.0 The Department of Atomic Energy of the Government of India (DAE) and the United States National Aeronautical and Space Administration (NASA) have jointly considered the fact that NASA plans, subject to funding and authorization, to launch two experimental Application Technology Satellites (ATS **F** and **G**) in the early 1970's. These satellites, to be placed in a synchronous equatorial orbit, have among their principal objectives exploration of the technical feasibility of erecting a large (30 foot) antenna structure in space and the ability to point it accurately ($\pm 0.1^\circ$). Planned for inclusion on the ATS satellite is an UHF FM transmitter which could be used to transmit one video and two audio channels to augmented conventional TV receivers. Other experiments will likely include meteorological, navigation and communications applications and scientific experiments in the space environment.
- 1.1 The Government of India has organized a Pilot Project in Delhi to test the effectiveness of TV for improving agricultural productivity, and is also deeply interested in the use of TV as a medium of mass communication for implementing programs for development. In addition, the DAE has established at Ahmedabad, an Experimental Satellite Communication Earth Station. As a result of these activities and interests, the DAE has considered with NASA the feasibility and desirability of conducting an instructional TV experiment utilizing the experimental ATS **F** satellite, which has been independently planned and programmed by NASA for other purposes which would proceed without regard to the specific Indian application discussed here.

- 1.2 The final report of the DAE/NASA Joint Study Group dated June 8, 1968 recommended that the DAE and NASA proceed to agree to such an experiment.

Title

- 2.0 The experiment with which this Memorandum of Understanding is concerned shall be known, and referred to, as the India/US ITV Satellite Experiment Project.

Basic Purpose

- 3.0 The DAE and NASA agree to use their best efforts to conduct an experiment in the use of ATS F for direct broadcast to rural community receivers and limited rediffusion through VHF transmitter of Indian-developed instructional TV program material.

General Objectives

- 3.1 The general objectives of the experiment will be to :
- Gain experience in the development, testing and management of a satellite-based instructional television system particularly in rural areas and to determine optimal system parameters.
 - Demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries.
 - Demonstrate the potential value of satellite broadcast TV in the practical instruction of village inhabitants.
 - Stimulate national development in India, with important managerial, economic, technological and social implications.

Specific Objectives

- 3.2 Indian Instructional Objectives :

3.2.1. Primary

- Contribute to family planning objectives.
- Improve agricultural practices.
- Contribute to national integration.

3.2.2. Secondary

- Contribute to general school and adult education.

- Contribute to teacher training.
- Improve other occupational skills.
- Improve health and hygiene.

3.3 Indian Technical Objectives :

Provide a system test of broadcast satellite TV for national development.

Enhance capability in the design, manufacture, deployment, installation, operation, movement and maintenance of village TV receivers.

Gain experience in the design, manufacture, installation, operation and maintenance of broadcast and/or distribution facilities to the extent that these are used in the experiment.

Gain an opportunity to determine optimum receiver density, distribution, and scheduling, techniques of audience attraction and organization, and to solve problems involved in developing, preparing, presenting and transmitting TV program material.

United States Technical Objectives

- 3.4 Test the design and functioning of an efficient, medium-power, wide band space-borne FM transmitter, operating in the 800-900 MHz band and gain experience on the utility of this space application.

General Experiment Plan and Responsibilities

- 4.0 Following initial NASA experimentation with ATS F, NASA would use its best efforts to position the satellite within view of India as early as possible to permit its use for the duration of this experiment. NASA will maintain control of the satellite while the use of the satellite for the ITV experiment will be under the exclusive control of India. The appropriate authorities of the Government of India shall be solely responsible for the coordination of radio frequencies, earth to satellite and satellite to earth, insofar as this experiment, India and the surrounding region are concerned, in the framework of frequency coordination established in the International Telecommunications Union.
- 4.1 It is understood by DAE and NASA that the space segment responsibilities of NASA under this agreement do not go beyond the provision of experiment time on the satellite for approximately one year; no continuing responsibility is implied.

- 4.2 The DAE will arrange for the transmission of instructional TV programs from its earth station at Ahmedabad to the satellite for broadcast to appropriate receivers provided and sited by Indian agencies in villages in India. The number of receivers contemplated is approximately 5,000, to be widely distributed. The actual figure may, however, be less depending upon experience with ground terminal costs. Responsibility for the TV programming is entirely with India and the use of the satellite would be in conformity with the specific objectives spelled out in paragraph 3.2. The Government of India shall be solely responsible with respect to any legal proceedings which may be brought regarding such TV programs, and shall hold the Government of the United States harmless therefrom.
- 4.3 The DAE and NASA recognize the possibility of utilizing the Ahmedabad earth station for monitoring the performance of the experimental satellite and for its station-keeping, and the DAE agrees to make this facility available to NASA for this purpose and further agrees to make available to NASA any data received from the satellite. While the DAE would not charge NASA for such use of the Ahmedabad earth station, costs incurred in making data available, such as the costs of purchase and transportation of tapes, would be met by NASA. The DAE and NASA also recognize the possibility of utilizing the Ahmedabad earth station for the purpose of conducting NASA-programmed scientific and technological experiments. These would be conducted on a time available basis and as mutually agreed.

Respective Scientific Responsibilities

- 4.4 The DAE will use its best efforts to :
- (1) Develop, provide and maintain in service the ground segment of the TV satellite experiment system that will carry out the technical objectives of the experiment.
 - (2) Develop, and utilize ITV program materials that will carry out the instructional objectives of the experiment.
 - (3) Develop and implement a mutually acceptable experiment evaluation plan.
 - (4) Prepare and publish interim progress reports at six-month intervals and a final report within 18 months of the end of Phase III (see explanation of phase below).
 - (5) Make available trainees for such training as may be agreed to between Program Managers.

- (6) Receive, record, reduce and analyze such ancillary engineering data as may be agreed between Program Managers.

4.5 NASA will use its best efforts to :

- (1) Place into geostationary orbit an experimental Applications Technology Satellite (ATS F), position it within view of India after a period of time, to be determined by NASA, but not greater than one year, and maintain it on station for approximately one year. The time required of the ITV experiment, which is hoped to be about 6 hours a day, will be made available for the experiment during this period as NASA continues its own experimental effort using the satellite. It is recognized that in practice power limitations in the satellite may require a reduction in the time available to approximately 4 hours.
- (2) Provide to the DAE such training and consultative services as may be agreed to between Program Managers.

Phasing of the Experiment

- 5.0 *Phase I : 1969-70.* India will undertake necessary improvements to the earth station at Ahmedabad. Research and development will continue on the design, prototyping, manufacture and testing of ground segment components. The Indian technicians involved will become familiar, to the extent necessary, with space segment characteristics. NASA will supply technical assistance and advice during this phase as agreed to between Program Managers.
- 5.1 *Phase II : 1970-71.* Phase I activities (which include the Delhi Experiment) will continue and intensify. This would provide new centers of expertise, uncover and solve operational problems, permit experiments with different approaches, and develop a cadre of personnel for the next phase in receiver deployment and maintenance and in programming.
- 5.2 *Phase III : 1972-73.* The parties will conduct an instructional TV experiment using the ATS F satellite.

Evaluation Plan and Report of Experiment Results

- 6.0 An essential element of the experiment is in its prompt and objective evaluation—wherever possible in quantitative terms—so as to provide maximum and timely information, available to all nations, that might be relevant to any future experiment or services in this area.

- 6.1 The DAE will develop a plan for evaluating this experiment quantitatively to the mutual satisfaction of the Program Managers. The results of this experiment will be made freely available.

Expected System Characteristics

- 7.0 The expected ITV satellite experiment characteristics are as follows, subject to minor modification as may be agreed to between Program Managers.

Space segment :

- 7.1 The ATS F satellite would be positioned within effective operational view of India for the purposes of this experiment, in synchronous equatorial orbit, with the 30-foot parabolic antenna pointed generally toward the center of India. An FM transmitter operating in the 800-900 MHz frequency range, with an RF bandwidth of approximately 30 MHz, will provide adequate power (80 watts) for transmitting TV program material and two audio channels to augmented conventional TV receivers.

Ground Segment :

- 7.2 In this experiment it is assumed that the up-link transmission to the ATS F satellite would be in the 4 to 6 GHz band. The experimental satellite communications earth station will be used for transmitting ITV program material to the satellite and for monitoring these transmissions and the performance of the satellite during the duration of this experiment. Augmented conventional TV receivers would be capable of receiving monochrome TV transmission from the satellite and one of two audio channels transmitted. For this purpose, the conventional receivers would be augmented by a front end, *viz.* a small parabolic receiving antenna (7-10 foot) and a preamplifier FM to AM converter of sufficient quality to receive transmission from the satellite. In high village density areas, transmission from the satellite could be received for rediffusion from VHF TV transmitters to conventional TV receivers located in villages. An additional receive-only facility, using a 20 to 30 foot parabolic antenna is required near the VHF TV transmitter.

Engineering and Experiment Data

- 8.0 All data relative to this experiment should be made available to both the DAE and NASA and should be processed as soon as possible.

Operational Coordination

- 9.0 DAE and NASA agree to designate a Program Manager who shall be individually responsible for the respective responsibilities of their agencies and jointly responsible for coordination and mutual agreement where required.
- 9.1 DAE and NASA agree to designate a Project Manager to coordinate agreed functions and carry out detailed day-to-day project requirements. Project Managers will constitute a Joint Project Working Group of suitable size and composition to assist in supervising the project.

Individual Funding

- 10.0 DAE and NASA will each meet all costs associated with its own participation and there will be no exchange of funds.

Application of Supplement of March 10, 1966

- 10.1 Both parties agree that the provisions of the Supplement to the Memorandum of Understanding of July 1, 1965, dated March 10, 1966, pertaining to the procedures for payment of travel and subsistence costs will be applicable to this project.

Public Information

- 11.0 In general, public news releases will be coordinated between DAE and NASA prior to release. If the information pertains solely to the participation of one of the parties, it may be released after informing the other party. However, if the interests of the other party are involved, such news releases will be coordinated with the other party. Basic "replies to queries" and press releases will be mutually developed as soon as possible and from time to time during the life of the project, so as to provide continuous up-to-date mutually agreed public information materials.

Participation

- 12.0 The experiment is to be conducted on the basis of this Memorandum of Understanding. The involvement of agencies or personnel from other nations or international bodies shall be subject to the prior agreement of DAE and NASA, and the provisions of this Memorandum of Understanding shall apply *mutatis mutandis* in such participations.

Termination Date

13.0 If the project provided for in this agreement is not substantially under way by January 31, 1975, it shall terminate on that date, unless both agencies mutually agree to an extension.

Sd/-

Secretary
to the Government of India,
Department of Atomic Energy
Date : 18th September 1969.

Sd/-

Administrator,
United States National
Aeronautics and Space
Administration
Date : 18th September 1969.